

MATH231BR HOMEWORK 1 (DUE THURSDAY, 2/5/26)

Exercise 1. Let $\pi: X \rightarrow S$ be any sheaf and $z: X \rightarrow S$ the zero section. Then $\text{im}(z) \subseteq S$ is open.

Exercise 2. Show that every morphism between sheaves of abelian groups is a local homeomorphism.

Exercise 3.

- (1) Let $f: S_1 \rightarrow S_2$ be a morphism of sheaves over X . Give a reasonable definition of an *image* subsheaf $\text{im}(f) \subseteq S_2$.
- (2) Give a reasonable definition of a *cokernel* sheaf $\text{coker}(f)$ over f .
- (3) Prove an analogue of the first isomorphism theorem for sheaves of abelian groups over spaces.
- (4) How does your first isomorphism theorem look on stalks?